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GEOPHYSICAL ABSTRACTS

NO. XXI

BY

F. W. LEE

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GEOPHYSICAL ABSTRACTS[1]

No. 21

Compiled by Frederick W. Lee[2]

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1. GRAVITATIONAL METHODS

(1) UN INSTRUMENT TRANSPORTABLE POUR LA MESURE RAPIDE DE LA GRAVITÉ

(A PORTABLE INSTRUMENT FOR QUICK MEASUREMENT OF GRAVITY)

By F. Holweck and P. Lejay

Comptes Rendus de l'Académie des Sciences, Paris,
vol. 190, No. 24, 1930, pp. 1387-1388.

The principles and the construction of the instrument are described. The ensemble of the instrument consisting of two supports provided with levelling screws and levels, two cells, two amplifiers, registering device, dry pile batteries, and four interchangeable pendulums is packed into two small boxes, the whole weight of which does not exceed 40 kilograms. Only a few minutes are required to put the instrument in operation.

Preliminary measurements carried out by the Observatory of Paris during several months have shown that the variations of the elasticity of invar during this time was negligible. The clamping device by which the pendulum is rendered immovable during transportation preserved it well from any injury.

A table shows the periods obtained for the two pendulums from the tests carried out along the base-line Paris-Dunkirk.--W. Ayvazoglou.

(2) DAS PENDEL MIT OSZILLIERENDEM AUFHÄNGEPUNKT

(A PENDULUM WITH OSCILLATING POINT OF SUSPENSION)

By Paul Hirsch

Zeitschrift fuer angewandte Mathematik und Mechanik,
vol. 10, No. 1, 1930, pp. 41-52.

The problem, which is not new, is treated by means of classical mechanics; in each phase, clearness is sought for. If the point of suspension of a pendulum is given a vertical harmonic movement with small amplitude and great frequency, the stability of the lower position of equilibrium increases and the lability of the upper decreases and in case of sufficiently strong oscillation changes into stability. The conditions change if the general case is not considered, but the oscillation is assumed to be in a direction inclined to the vertical. In this case there are two stabile and two labile positions of equilibrium determined by the roots obtained from an equation of the fourth degree; only one value for each position exists in case the oscillation is weak.

In case of vertical oscillation the two labile and one stabile positions of equilibrium coincide in the upward direction. Preliminary calculations on the effect of a mathematical pendulum are made; two generalizations are

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discussed: 1. Elliptical oscillation. The point of suspension of the pendulum is supposed to perform harmonic oscillation of equal frequency in two directions--that is, it describes an ellipse. In this case the pendulum has usually six positions of equilibrium. 2. Linear oscillation of a physical pendulum is a symmetrical position. A generalization results from the discussion. The following cases are examined: 1. Linear oscillation of a physical pendulum. 2. Circular oscillation. For this special case of the elliptical oscillation there results a duality with the linear oscillation--that is, a conformity of the positions of equilibrium if the direction of the linear oscillation is interchanged with that of the line perpendicular to the plane of the circular oscillation and the words "stabile" and "labile," as well as "upper" and "lower", are substituted one for another. 3. Elliptical oscillation. Linear oscillation which does not proceed harmonically but with a constand velocity and a sudden reversal of it can be easily treated in the same way. Only the results obtained in this case are given. The direction of all the positions of equilibrium can be calculated by means of a simple approximate proceeding. The frequency with which the pendulum can oscillate around the stabile positions of equilibrium is explained.--Author's abstract translated by W. Ayvazoglou.

(3) DIE INVARIABILITÄT UND ABSTIMMUNG VON MINIMUMPENDELN

(THE INVARIABILITY AND ADJUSTMENT OF MINIMUM-PENDULUMS)

By E. Kohlschütter

Zeitschrift fuer Geophysik, vol. 6, No. 8, 1930, pp. 466-476.

The question raised by O. Meisser concerning the development of a formula for the variability of invariable minimum gravitational pendulums produced by small knife-edge displacements or reasons having a similar effect is formulated and applied to pendulums which can be manufactured practically. A table for this variability is calculated. Formulas for calculation and adjustment of cylindrical minimum-pendulums are derived.--Author's abstract translated by W. Ayvazoglou. Note: The article is followed by two brief discussions, one written by O. Meisser under the heading: Bemerkung zu der Arbeit "Die Invariabilität und Abstimmung von Minimum-pendeln" by E. Kohlschütter (Remarks on E. Kohlschütter's work "The Invariability and Adjustment of Minimum Pendulums); the other is an "Answer" (Erwiederung) written by E. Kohlschütter.

(4) NUOVI CALCOLI DI INFLUENZE GRAVIMETRICHE DI TERRENI SUPERFICIALI E PROFONDI

(NEW CALCULATIONS ON THE GRAVIMETRICAL INFLUENCE OF SUPERFICIAL AND DEEP MASSES)

By Arnaldo Belluigi

Ergänzungshefte fuer Angewandte Geophysik, vol. 1, No. 2, 1930, pp. 141-148.

The author establishes new calculations on the gravimetric influence

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of superficial and subsurface disturbing masses. He refers to some of his previous investigations concerning topographic correction and develops a new process in connection with it. The author tries to solve the question of the influence of disturbing masses at a depth by approximation of imaginary disturbing bodies to the real ones. A special solution for an imaginary body of the form of a parallelepiped is given.--Author's abstract translated by W. Ayvazoglou.

(5) VERGLEICH DER AUFZEICHNUNGEN ZWEIER GALITZINPENDEL MIT VERSCHIEDENER EIGENPERIODE

(COMPARISON OF RECORDS OF TWO GALITZIN PENDULUMS WITH DIFFERENT NATURAL PERIODS)

By Helmut Landsberg

Gerlands Beiträge zur Geophysik, vol. 27, No. 3-4, 1930, pp. 326-359.

The same component was registered in the Taunus Observatory by two Galitzinpendulums, one with the natural period of 3 seconds and the other of 18 seconds. The records of these pendulums, already discussed by B. Gutenberg in his article "Registration made with two Galitzin-pendulums with different periods," (see Geophys. Abs. No. 13, p. 11), were submitted to a systematic investigation. The advantage of the installation of the instruments consisted of the fact that the starting of the earthquake was very distinctly recorded by the pendulum with short periods; clear records of the after-shocks were obtained by this pendulum also. Ninety-four earthquakes were investigated and it was proved that waves of long periods never arrived before the waves of short periods.

In more than 50 per cent of all the cases there were no waves of long period in P; they appeared there only in the later phases. The possibilities of the origin of a time difference of from one-half to 2 seconds in P of both kinds of waves are discussed. The phase maximum of long-period pendulum in P was generally delayed if compared with the short-period pendulum. The ratio of maximum amplitudes of the P-phase in both pendulums shows a distinct dependence on the focus-distance.

There were unknown groups of short waves observed between P and S during most earthquakes; they were used for the construction of some travel-time curves, of course with restrictions. A general comparison of the appearance of long and short waves at single phases of earthquakes was carried out and it was proved that almost all the groups which were longitudinal on their whole course have shown waves of short periods. The question of the appearance of short periods in changing waves is discussed, and a general view on the proportion of the different phases in the two pendulums is given.

Microseisms of only 4 to 10 seconds were investigated because only these earthquakes were recorded by both pendulums. A dependence of the periods in the two pendulums could not be established. Concerning the yearly course of the periods, it was found that the long and the short periods were recorded at the same time in summer as well as in winter, and only the amplitudes which

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belong to the single waves were changed. The influence of the English and Norwegian surf was investigated, and it was again established that microseisms and surfs always change in the same sense.--Author's abstract translated by W. Ayvazoglou.

(6) GEOLOGICAL INTERPRETATION OF MAGNETOMETRIC AND GRAVIMETRIC OBSERVATIONS WITH THE AID OF APPARATUS FOR MECHANICAL CALCULATIONS (IN RUSSIAN)

By G. Gamburtzeff

Journal of Applied Physics, Moscow,
vol. 5, No. 3-4, pp. 227-235, and vol. 6, No. 1, pp. 62-67, 1929.

The author describes mechanical instruments by which the deviations of the magnetic potential and gravimetric potential of an infinitely long homogeneous cylinder of any section can be calculated. The whole course of the distribution curve of the force of gravity perpendicular to the peripheral line of the cylinder can be graphically represented directly by encircling the borders of the cross section of the cylinder.

Owing to the well-known relation between the magnetic potential and gravitational potential (in case of a homogeneous magnetization) the apparatus can serve for geological interpretation of both gravimetric and magnetic observations. Theoretical calculation for constructing the instruments and graphical designs of them are given.--W. Ayvazoglou.

2. MAGNETIC METHODS

(7) BEZIEHUNGEN ZWISCHEN GEOLOGISCHEN UND ERDMAGNETISCHEN VERHÄLTNISSEN

(RELATION BETWEEN GEOLOGIC AND EARTHMAGNETIC CONDITIONS)

By F. W. Pfaff

Zeitschrift fuer Praktische Geologie,
vol. 38, No. 9, pp. 129-135 and No. 10, pp. 154-159, 1930.

Wettergebirge has been chosen by the author for investigation of the way in which the earthmagnetic values of declination, horizontal intensity, and inclination are affected by the geological structure of the upper earth layers. The best way to understand the correlation between the geological and magnetic conditions is to compare the values of the magnetic elements which can be expected under normal conditions with those obtained by measurements. In a table accompanying this article Pfaff gives the measured and normal values of the magnetic elements as well as the differences between these values for a few formations. At the end of the table the mean values of the differences are calculated for shell limestone, belemnite limestone, raibler and haupt dolomite.

The second part of the article deals with influences upon the values of the magnetic elements in the region described in connection with:

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The faults and lines of disturbandes,

The influence produced by a syncline,

The reduction for a level terrane,

The explanation of the small values for H and I in the northern Mittenwald,

The influence caused by the great lines of disturbance.

In conclusion the author says that, if the measured values only are compared, the direct influence of the geological conditions upon the values of the magnetic elements can hardly be noticed, but they become noticeable when corrected (specific magnetization) for the topographic and geographic positions, as well as for the thickness of the layers (geological and tectonic height); thus the following conclusion has been drawn: For most of the stations of the region in which the measurements were carried out, the specific magnetization agreed with the tectonic height.--W. Ayvazoglou.

3. SEISMIC METHODS

(8) PROGRESS OF SEISMOLOGICAL INVESTIGATIONS IN THE UNITED STATES

By N. H. Heck

U. S. Coast and Geodetic Survey. Special Publication No. 167, 14 pp.

In this pamphlet the author gives a brief description of the progress of seismological investigations in the United States covering a period from July 1, 1927, to January 1, 1930. Attainments made during this period affected the following problems of seismology:

1. Installation of high-grade instruments;
2. Development and perfection of new types of instruments;
3. Expansion of programs of local investigations in regions more frequently subject to earthquakes;
4. Expansion of programs of teleseismic investigation;
5. Attack on the engineering, insurance, and other practical phases of the problem;
6. Unprecedented public interest in the subject.

The pamphlet is divided into two parts; the first deals with the work of the Coast and Geodetic Survey; in the second a summary of earthquake investigations in the United States made also by other institutions is given.

Two maps showing (1) the seismological stations of the United States

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and adjacent Canada and (2) important seismological stations in the United States and regions under its jurisdiction are added.

A list of teleseismic stations distributed in the United States concludes the article.--W. Ayvazoglou.

(9) SEISMISCHE UNTERSUCHUNGEN AUF DEM PASTERZEGLETSCHER

(SEISMIC INVESTIGATIONS ON THE PASTERZE GLACIER)

By B. Brockamp and H. Mothes

Zeitschrift fuer Geophysik, vol. 6, No. 8, 1930, pp. 482-500.

The authors describe the seismic investigations carried out by them in August, 1929, on the Pasterze Glacier (Eastern Alps). The purpose of the work was as follows:

1. To make seismic measurements at fixed places of the glacier basin.

2. To collect material, following the direction of the work established by the Geophysical Institute of Gottingen, for the study of special questions connected with the propagation of waves.

Determinations on the following waves were made:

1. Longitudinal waves, V_p = 3,580 meters per second.

2. Transversal waves, V_s = 1,670 meters per second.

3. Longitudinal waves which passed through the rocks situated below the glacier, V_{pl} = 5,850 meters per second.

4. Longitudinal and transversal waves which passed through the ice at the lower border of the ice, U_p and U_s.

5. Reflected longitudinal waves, R_I and R_{II}.

The P^l-waves and the U_p-waves were used for the determination of the mean depth, and the R_I-waves were used for calculation of single values of the depth.

They served for the construction of longitudinal profiles and cross profiles of the glacier.

A series of figures showing these profiles is given. More than 70 seismograms were taken. Nine of them are shown in the figures.--W. Ayvazoglou.

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(10) DAS IMPULSFELD DER PRAKTISCHEN SEISMIK IN GRAPHISCHER BEHANDLUNG

(THE IMPULSE FIELD OF PRACTICAL SEISMICS TREATED GRAPHICALLY)

By E. A. Ansel

Ergänzungshefte fuer angewandte Geophysik,
vol. 1, No. 2, 1930, pp. 117-136.

The author derives graphical methods by which the strata of the subsoil, the inclination of the strata and the discontinuities of the strata can be determined in more or less simple cases with the aid of the travel-time curve.

The great importance of the "contact curve" for the graphical treating of the impulse field is mentioned, and the construction of this curve from the data obtained for the travel-time curve is explained.--W. Ayvazoglou.

(11) ERGEBNISSE SEISMISCHER UNTERSUCHUNGEN UEBER DEN SCHICHTENAUFBAU VON NORD DEUTSCHLAND

(RESULTS OF SEISMIC INVESTIGATIONS MADE OVER THE STRUCTURAL LAYERS IN NORTH GERMANY)

By O. Barsch and H. Reich

Ergänzungshefte fuer Angewandte Geophysik,
vol. 1, No. 2, 1930, pp. 165-188.

The article is divided into the following three parts: (1) General remarks. (2) Seismic investigations near Dobrilugk. (3) Seismic investigations in Priegnitz and Schleswig-Holstein.

Diagrams showing the travel-time curves and the seismograms obtained from the investigations in the regions mentioned above are given.

Based on the results from this work in various regions of North Germany the authors determined the values for the velocities of wave propagation in a series of rocks:

Dry sandy diluvium	700 to 1,000 meters per second.
Watered diluvium, Marly diluvium, Sandy-clayey Miocene, Clayey-sandy Oligocene	1,000 to 1,700 meters per second.
Marley Eozoic (?)	1,800 meters per second.

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Chalk - - - - - - - - - - - - - - - - 2,100 to 2,250 meters per second.

Productive carbon (clay slate and sandstone - - - - - - - - - - - - about 3,800 meters per second.

Cambrian (clay slate and quartzites) about 5,000 meters per second.

A few other layers with V = 3,000 to 3,600 meters per second, found at different depths, are mentioned but with much caution. In spite of their reserve, the authors seem to be of the opinion that the deeply situated layers of discontinuity, which for all the profiles given in the article have an almost horizontal position, may be considered transgressive layers. While such a transgressive layer, covered with chalk, was found in Priegnitz at about 800 meters in depth, in Schleswig-Holstein the chalk was missing and the depth of the transgressive layer was only about 600 meters.

The real reason for the great magnetic and gravimetric disturbances in North Germany could not be established with certainty by seismic methods. Therefore it may be concluded that these rocks, at least as far as the regions investigated are concerned, are probably situated at a depth greater than 1,000 meters.

The well-known subterranean structure of the region under investigation was of great assistance to the authors in studying the course of the seismic waves, as well as other problems of applied seismics important from both practical and theoretical viewpoints.--Author's abstract translated by W. Ayvazoglou.

(12) À PROPOS D'UNE ONDE LONGUE DANS LA PREMIÈRE PHASE DE QUELQUES SÉISMOGRAMMES

(CONCERNING ONE LONG WAVE APPEARING IN THE FIRST PHASE OF SOME SEISMOGRAMS)

By O. Somville

Gerlands Beitrage zur Geophysik, vol. 27, No. 3-4, 1930, pp. 437-442.

In this article the author mentions a very striking long wave of a period of about 24 seconds which was registered in some seismograms obtained in the Observatories of Taunus, De Bilt, and Uccle by means of Galitzin pendulums with long natural periods during the earthquakes observed in Italy in 1928, 1929, and 1930.

This wave, which the author calls the PL wave, has so far been observed only in connection with the Italian earthquakes. Thus, before trying to give an interpretation on the nature of this wave the author raises the following questions: Can the PL-wave be observed in other directions than the northern, as in Italian earthquakes? Has it been observed in other cases? He adds that, of course, the answer to the questions may be difficult, as there are only a few stations working with seismographs with long natural periods.

In the last figure the author has drawn, based on observations

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mentioned in this article, a first curve of times of propagation of the PL-wave for distances from $\triangle$ = 500 kilometers to $\triangle$ = 1,400 kilometers.--W. Ayvazoglou.

4. ELECTRICAL METHODS

(13) RESISTIVITY MEASUREMENTS OF OIL-BEARING BEDS

By F. W. Lee and J. H. Swartz

U. S Bureau of Mines, Technical Paper 488, 1930, 12 pp.

In the introduction to this paper the authors propose to show the results of experiments in oil-bearing territory, using electrical resistivity methods. The development of these methods is briefly mentioned.

Under the heading of "Partition Theory" two methods of approach for determining the character of subterranean formations are evolved. In the first class the authors place a theoretical discussion of parallel beds with different resistivities in each one, as discussed by Hummel, and in the second the results of field observations without complete mathematical analysis.

To test this theory a district in Allen County, Ky., was selected. The oil here is at an extremely shallow depth and therefore all conditions are favorable for discovering oil as outlined in the article. A geological description of territory is given and factors controlling the accumulation of oil in this area, as well as the groups into which the oil sands of Allen County fall, are mentioned. The process of taking measurements and apparatus used for observations (Rooney-Gish apparatus) is described. The contour of the testing site is shown in a figure.

The results of measurements carried out at three stations are illustrated by diagrams. The work was carried out in December, 1929.

In conclusion the authors say that although the results of these tests show favorable reactions under certain circumstances, they require much more work to establish their validity; thus this paper may serve as an experimental guide to persons interested in locating oil at shallow depths, and continued application of these methods is necessary to improve their technique before very deep investigations of oil formations can be made with reliable results.

A list of books relating to electrical resistivity methods is added.--W. Ayvazoglou.

(14) THE USE OF GEOELECTRICAL METHODS UNDERGROUND

By G. P. Haller

The Mining Journal (Phoenix, Arizona), vol. 14, No. 9, 1930, pp. 11 and 30.

In this article the author discusses the application of geoelectrical methods of prospecting to underground investigation by which the miner is given

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a chance to obtain more definite information as to the presence of ore before further mining exploration is begun.

The underlying principles of the method are mentioned briefly and the effects obtained by geoelectric measurements in different cases by which the determination of the location of existing ore bodies is possible are shown in a series of figures. The necessity of testing the conductivity of samples of the minerals which occur in the area to be investigated before starting the actual survey is mentioned. Illustrations obtained from geoelectrical investigations of copper mines accompany the article.

In conclusion Haller says that the real benefit to be derived by the mining engineer and the geologist from this branch of geoelectrical investigation is evidenced by practical experience, but he adds that although of great value in capable hands the results can be more damaging than helpful in the hands of the inexperienced, as only a thoroughly trained expert in geoelectrical methods is able to compute the results and to interpret the obtained data geologically and with exactness. Furthermore, a close cooperation with the geologist is essential.--W. Ayvazoglou.

(15) GEOPHYSICAL STUDY PREDICTS ROCK CONDITIONS AT TUNNEL SITE

By E. E. Carpenter and E. G. Leonardon

Reprint from Engineering News-Record, September 4, 1930.

Lack of knowledge of underground conditions at the sites of certain engineering works, especially dams and tunnels, affects construction methods and costs to such an extent that advance information in regard to rock formation and water conditions is of the utmost value.

No attempt is made in this article to detail the technique of the geophysical exploration, and only a brief explanation of the theory of rock resistivity upon which the electrical method is based is given.

The authors describe the electrical exploration work at Bridge River Tunnel carried out in the summer of 1928.

The constitution of the rocks encountered along the tunnel which have been bored through since are indicated, proving the accuracy of the results obtained by examination of the resistivities of the rocks.--W. Ayvazoglou.

(16) ON THE RESULTS OF THE ELECTRICAL PROSPECTING IN THE REGION OF NOVO-GROZNY (IN RUSSIAN)

By A. Shaiderov

Azerbeidjanskoe Neftianoe Khoziaistvo,
vol. 10, No. 9, 1930, pp. 78-85

After a brief explanation of the principles of electrical methods of prospecting, Shaiderov describes the methods carried out for the electrical investigation of the geological structure in the region of Grozny in the year 1929-30.

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The following methods were applied:

1. The resistivities of rocks deposited at certain depths were determined by construction of electrical profiles.

2. The resistivity of rocks at different depths was determined by electrical boring.

3. The extension of rocks and their inclination was determined by applying stakes.

For the construction of profiles corresponding to different depths three different distances (150, 600, and 1,000 meters) between the electrodes were applied.

Based on the favorable results of investigation, which agreed entirely with the known geological data of the region, the author draws the conclusion that electrical methods of prospecting can be applied with advantage in case the horizons under investigation have distinct electrical characteristics.

The article is illustrated by the following maps:

1. A map showing the character of the electrical profiles for distances of 150 and 1,000 meters between the electrodes.

2. A map showing the results of electrical measurements at a depth of from 150 to 200 meters.

3. A map showing the results of electrical measurements at a depth of from 20 to 30 meters.

4. A section and profile along the line of shafts.

5. A map of vectors of inclination of the rocks.

W. Ayvazoglou.

(17) RESULTS OF SOME RECENT GEOPHYSICAL TESTS

By L. H. Henderson and V. P. Pentegoff

Reprint from The Mining Journal, Phoenix, Arizona, 3 pp.

Based on the accompanying maps and figures, the authors discuss a series of problems solved by electrical methods of prospecting:

1. Map showing resistivity survey of Silver Monument Mine, Chloride, N.M.

2. Map of detailed electrical survey for Spruce Mountain Mining Co., Sprucemont, Nev.

3. Details of the electrical survey of the Silver Plume property of Minaret Consolidated Mines Co., Cananea, Sonora, Mexico.

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4. Map showing area in which electrical survey was conducted at Chino Mines, Nevada Consolidated Copper Co., Santa Rita, N. M.

5. Comparative profiles of results from electrical survey and drill prospecting at the Nevada Consolidated Copper Co., Chino Branch.

In all the cases the results of geophysical surveys were very satisfactory and agreed with the data obtained by drilling.--W. Ayvazoglou.

(18) AMPLIFICATORI GEOMETRICI DI PICCOLE DEFORMAZIONI DI LINIE DI CORRENTE IN UN SUOLO ARTIFICIALMENTE ELETTRIZZATO

(GEOMETRIC AMPLIFIER OF SMALL DEFORMATIONS OF LINES OF CURRENT IN AN ARTIFICIALLY ELECTRIFIED SOIL)

By Arnaldo Belluigi

Ergänzungshefte fuer Angewandte Geophysik,
vol. 1, No. 2, 1930, pp. 137-140

The author gives the theory of a geometrical "amplifier" by which the small deformations of the lines of current in an artificially electrified soil can be disclosed.

He concludes that these lines can be used for the interpretation of the geoelectrical results.--Author's abstract translated by W. Ayvazoglou.

(19) EINIGE ÜBERSCHLAGSRECHNUNGEN ZU DEN PHASENVERHÄLTNISSEN IM POTENTIALFELD BEI GEOPHYSIKALISCHEN BODENUNTERSUCHUNGEN MIT WECHSELSTROM MITTLERER FREQUENZ

(SOME CALCULATIONS CONCERNING THE PHASE-RATIO IN A POTENTIAL FIELD DURING GEOPHYSICAL INVESTIGATION OF THE SOIL WITH ALTERNATING CURRENT OF MEDIUM FREQUENCY)

By W. Heine

Ergänzungshefte fuer angewandte Geophysik,
vol. 1, No. 2, 1930, pp. 156-164

With the aid of the approximate formula derived previously, the author calculates the phase displacement between two lines of current in media of unequal electrical conductivity for different values of conductivity.

The dependence of the phase displacement on the absolute values of the specific gravities of the two media is proved.

The difference in phase displacement between the lines of current placed at 1 and 10 meters distant from the deposit, the effect of this difference for measurements of the potential lines being the highest in case of minimum width, obtains higher values only if one of the two media has a specific resistance of the order of from 10^5 to 10^6 ohms, while in case of lower or higher values this phase difference remains very small. This agrees

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with experience. By using an approximate proceeding the author derives and calculates also the phase displacement resulting from the change of current density along the central perpendicular line drawn on the line connecting the electrodes ("zero" potential line).--Author's abstract translated by W. Ayvazoglou.

(20) DAS ELEKTRISCHE UND MAGNETISCHE FELD UM EINEN "ERDSTRAHLER"

(THE ELECTRICAL AND MAGNETIC FIELD AROUND A "DIPOL")

By Herbert von Ludwiger

Ergänzungshefte fuer angewandte Geophysik,
vol. 1, No. 2, 1930, pp. 189-226.

Contents of the article:

Introduction: Purpose of the work.

Description:

Chapter 1. The elliptically polarized alternating field examined at one point of the field measured.

Chapter 2. The measurements, the terrane on which the measurements were made, and apparatus.

Chapter 3. Summarized representation of the measured data.

Chapter 4. Physical meaning of the curves.

The article deals with measurements of the electromagnetic alternating field around a dipol in a medium of poor conductivity. In case of alternating currents of the tone-frequency character, the normal field at the point of measurement was found to be an elliptically polarized rotation field.

Thus the measurement proceeding required the taking into consideration of the time necessary for the flow of the current within one period of the alternating current produced. Therefore, at each point of measurement, the electrical field inside of the soil, as well as the magnetic field above the soil, was measured for each series of azimuths, with regard to the amplitude and phase, for two quadrants around a dipol of one-fourth square kilometer; the voltage branched off from the excitation served as a comparison voltage for the phase and the amplitude. The measured amplitude curve can, as proved by mathematical calculation, be replaced by a "two-circle-diagram" from which the azimuth, phase, and amplitude of the major axis of the oscillation ellipse can be determined. The ratio of the axes can be determined from the course of the phase with the aid of a simple mathematical relation.

According to geological investigation, the subsoil of one of the quadrants consisted of limestone deposited horizontally.

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Eighty-four points of measurements distributed according to a polar coordinate scheme were selected here. The second quadrant was characterized by a tectonic disturbance of the "Kleperspalte," a water-conducting Keuper-graben in the midst of shell limestone. Forty-five points, distributed according to the rectangular coordinate scheme, were measured here.

The following results were obtained from measurements:

1. Lines of equal maximum amplitude for the electrical, as well as magnetic components of the field, are circles around the dipol; the circular form is influenced by the tectonic disturbances only if these disturbances are in connection with strong difference in conductivity.

2. The electric field of the dipol is linear only at the points situated at the prolongation of the dipol axis and its normals passing through the dipol; in all the other points the field is elliptically polarized. Lines of equal ellipticity are closed curves. Lines of equal ellipticity of the horizontal magnetic field are parabolas.

3. The electric current spreads out in the ground in the form of a wave extending from the dipol with a constant velocity of propagation, similar to the phenomenon of the transverse wave observed previously in a cable. The phase conditions in the main direction of the current are, owing to the ellipticity of the field, of no physical importance; lines of equal phases for fixed components, given by the coordinates of the dipol, were calculated and drawn; for the phase φ_z (vertical phase) and φ_y (component in the direction of the dipol-normal) the drawing resulted in circles around the dipol. From φ_y resulted a transverse wave twice as long as from φ_z.

4. Clear information on the tectonic of the subsoil could not be obtained from the results of the amplitude measurements and phase measurements carried out with probes, owing to a very strong influence of the heterogeneity of the surface of the soil.

5. From the geophysical viewpoint the elements of the magnetic field, a, φ_y, φ_z, could be evaluated the best, as for these elements the lines of connection of equal values in an undisturbed field were represented by concentric circles around the dipol; or in other words their value was proportional to the distance from the dipol.

6. Deposits of different conductivity cause disturbances of the normal course of the field, the phase curves reacting with a much greater sensitivity than the amplitude curves.--Author's abstract translated by W. Ayvazoglou.

(21) DIE GEOELEKTRISCHEN UNTERSUCHUNGEN MIT WECHSELSTROM

(GEOELECTRIC INVESTIGATIONS WITH ALTERNATING CURRENT)

By Wilhelm Geyger

Zeitschrift fuer Hochfrequenztechnik,
vol. 34, Nos. 5 and 6, 1930, pp. 184-190 and 228-233.

Contents of the article:

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1. Introduction.

2. Theoretical bases of geoelectrical methods.

3. Principles of measurements used in geoelectrical methods.

4. Direct-current measurements.

5. Alternating-current measurements.

6. Representation of vibration phenomena that occur.

7. Method of the compensation measurement proceeding used.

8. Carrying out of terrane measurements in practice.

Theory and measurement proceedings of the electrical methods of prospecting are discussed, especially those carried out with alternating current of medium frequency of about 600 Hertz.

The author deccribes a complex "slide-wire alternating-current compensator (Schleifdraht-Wechselstromkompensator) developed by him, by which the determination of the two components of the alternating electromotive force perpendicular one to another (actual component and reactive component) can be determined directly.

Eighteen figures and 33 references complete the article.--W. Ayvazoglou.

(22) THE CONDITIONS FOR PROPAGATION OF ELECTROMAGNETIC WAVES IN THE EARTH ATMOSPHERE (IN RUSSIAN)

By S. Krutschkow

Journal of Applied Physics, Moscow, vol. 7, No. 3, 1930, pp. 61-79.

The results of investigations made by several authors show that the upper layers of the earth-atmosphere consist of oxygen, nitrogen, and helium. It seems that in the regions in which the aurora borealis occurs (altitude 80 - 130 kilometers) a certain part of the oxygen-molecules dissociates into atoms. Spectroscopic examination of the night illumination of the sky proved the existence of this dissociation.

After a discussion of various theories the author concludes that the temperature in the free atmosphere can not be established with certainty. The following are taken as possible temperatures: 180, 190, 200, 210, 220 and 300°, the most probable being those from 215 to 300°. Calculations made according to the formulas given in the article result in the conclusion that at altitudes of from 102 to 138 kilometers on, a complete dissociation of oxygen molecules takes place. This conclusion has been supported by the results of spectroscopic examinations.

Concentration of electrons calculated according to the formulas given

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in the article reaches its maximum value (about 3.10^6 electrons per 1 $cm.^3$) at altitudes of from 115 to 168 kilometers. This concentration of electrons is not in contradiction with the results of investigations made on the propagation of electromagnetic waves.

The calculated altitudes of the Heaviside layer agree with the results of examinations. These altitudes depend on the length of the wave, initial angle of the wave, and the temperature of the stratosphere; they vary from 87 to 168 kilometers.--Author's abstract translated by W. Ayvazoglou.

(23) MESSUNGEN DER ANZAHL DER ATMOSPHÄRISCHEN ELEKTRIZITÄTSTRÄGER BEI NIEDERSCHLÄGEN

(MEASUREMENTS OF THE NUMBER OF ATMOSPHERICAL CARRIERS OF ELECTRICITY DURING PRECIPITATION

By K. Kähler

Gerlands Beiträge zur Geophysik, vol. 27, No. 2, 1930, pp. 226-240.

The number of atmospherical ions of all velocities, of small, intermedial, and large ions have been counted at the Potsdam observatory during rains, squalls, and thunderstorms. The results of these measurements are compared with synchronous registrations of the atmospheric potential gradient. The electrical process in rain clouds, especially the new Wilson-theory on the origin of the electrical charges of the drops, is discussed.--Author's abstract.

5. RADIOACTIVE METHODS

(24) LA TENEUR EN RADIUM DES EAUX PÉTROLIFIÈRES DE BAKOU ET DU DAGHESTAN

(RADIUM CONTENT OF PETROLIFEROUS WATERS IN THE REGIONS OF BAKU AND DAGHESTAN)

By B. Nikitin and L. Komleff

Comptes Rendus de l'Académie des Sciences, Paris, vol. 191, No. 7, 1930, pp. 325-326.

The authors studied the petroliferous waters in the regions of Baku and Daghestan (Caucasus).

Seventy-two samples taken from the region of Baku were examined. The emanation method was used. Measurements were made with Schmidt's electrometer. The highest content of radium, averaging 3×10^{-11} Ra per cent (in weight), was found in the waters of the Bibi-Eibat group (Baku), the richest at a depth of about 600 meters.

Twenty-two Daghestan samples were studied. The average content of Ra was 1.2×10^{-10} per cent. These waters contained about 0.03 per cent of barium. There was no proportionality between the contents of barium and radium.

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Several wells are very rich in waters, their output being about 640,000 liters per day. Thus, the quantity of radium brought by them to the surface of the earth reaches about 0.2 gram per year.--W. Ayvazoglou.

(25) THE RADIOACTIVITY OF STONE MOUNTAIN

By James A. Hootman and W. S. Nelms

The Physical Review, vol. 35, No. 11, 1930, pp. 1431-1432.

This is an abstract of a paper presented at the American Physical Society held in Washington, D. C., April 24-26, 1930. The abstract reads as follows:

"The radioactive content of the waters which issue from the base of the unique geological formation known as Stone Mountain (Georgia) was determined. Tests were made of a number of large springs well distributed around the base of the mountain, and of other shallower sources above and below the 1,000-foot level. The method employed was the Schmidt shaking method, in which a known volume of water is thoroughly shaken with a known volume of air in a closed container. The resulting mixture of air and radium emanation is then pumped into an electroscope, and the rate of fall of the leaf is a measure of the radioactivity of the water. The electroscopes were calibrated by means of the Duane and Laborde formula, and corrections were made for temperature and pressure. This method has been shown by Ramsey to have an accuracy of about 3 per cent. A majority of the springs tested were highly radioactive, the value for the highest being $15,980 \times 10^{-12}$ curies per litre. This value is nearly twice the maximum reported by Boltwood for 44 radioactive springs, and more than half as large as the maximum reported by Lester for 178 mineral waters of Colorado."--W. Ayvazoglou.

(26) THE NATURE OF COSMIC RADIATION

By L. F. Curtiss

The Physical Review, vol. 35, No. 11, 1930, p. 1433.

This paper was among those included in the program of the meeting of the American Physical Society held in Washington, D. C., April 24-26, 1930. The abstract of this paper, as published in the Physical Review, reads as follows:

"The Geiger-Müller tube counters placed vertically above each other show, in addition to accidentals, coincidences which have been ascribed to cosmic rays. Absorption experiments by Bothe and Kohlhörster indicate that these rays are corpuscular. The author has made observations with the poles of a large electromagnet between two counters, recording the number of coincidences with and without the magnetic field. With the field used of 7,000 gauss over an area 24 centimeters in diameter, a parallel beam of 10^9 volt electrons which passes through the upper counter would be deflected sufficiently just to miss the lower counter in spite of the fact that the $H\rho$ for such electrons is approximately 3×10^8. Since the radiation is actually diffuse with a maximum in the vertical direction, using two counters one can expect only a slight

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decrease in the coincidences if they are caused by high-speed electrons. However, if they are due to ultra γ-rays, no such effect should be observable. Making the theoretical allowance for accidentals, a decrease of the order of 25 per cent has been observed in the coincidences which may be attributed to cosmic radiation. This confirms the existence of a corpuscular radiation of very high energy."--W. Ayvazoglou.

(27) UEBER DEN KLEINIONENGEHALT DER LUFT AUF HELGOLAND UND SEINE ABHÄNGIGKEIT VON METEOROLOGISCHEN FACTOREN

(ON THE CONTENT OF SMALL IONS IN THE AIR IN HELGOLAND AND ITS DEPENDENCE ON METEOROLOGICAL FACTORS)

By Oskar Mathias

Gerlands Beiträge zur Geophysik, vol. 27, No. 3-4, 1930, pp. 360-377.

Statistical investigations of the numbers of small ions obtained in Helgoland have revealed striking relations with meteorological and maritime factors, especially with those closely connected with the number of nuclei (direction of wind, transparency of atmosphere, sunshine.) The author recommends that in future in counting the ions the Aitken-nuclei be also counted at the time of observations as, according to investigations described in this article, they are of the greatest importance for the number of small ions. A direct influence of temperature could not be proved. Owing to small air-pressure changes during the time of observations (maximum 14 mm. Hg.), the investigation of its influence upon the number of ions was considered unnecessary and was not carried out. Interesting correlations with the degree of cloudiness and the tides were revealed. The increase in cloudiness caused an increase in the number of ions; this effect remained, of course, to be examined and explained. The average number of small ions was considerably greater at high tide than it was at low tide, a fact which seems to indicate a local formation of nuclei.

The relation of $\bar{n}_+ \mid \bar{n}_-$ showed a distinct correlation with the number of nuclei as well as with the relative humidity. This relation can be explained by the supposition that there exists a different capacity for accumulation of positive or negative small ions around the nuclei, respectively around the small water drops (formation of large ions). The relation $\bar{n}_+ \mid \bar{n}_-$ to the height of the waves is more complicated and requires further investigation.

The correction of the number of ions resulting from re-calibration of the anemometer does not meet the conclusions drawn by Hess concerning the balance of ionization. The relation between the number of ions and the average life of small ions shows a difference from the linear correlation for high values of $\bar{n}$; this can be completely explained by the deviation from the linear law of recombination.--Author's abstract translated by W. Ayvazoglou.

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6. GEOTHERMAL METHODS

(28) THE STUDY OF EARTH TEMPERATURES IN OIL FIELDS ON ANTICLINAL STRUCTURE

By K. C. Heald

American Petroleum Institute, Bulletin 205, October, 1930, pp. 1-8

The purpose of the work described was, in general, to determine, if possible, the conditions responsible for variations in the rate at which temperature increases with depth, and for the changes that take place between one locality and another. More specifically it was proposed to determine, in so far as possible, relations between earth temperatures and the occurrence of oil and of helium-bearing gas in both local and regional geologic structure. It was further proposed to secure data on the relationships between earth temperatures and stratigraphic conditions, water circulations, and, in short, any geologic conditions that may be pertinent in connection with the discovery and the production of petroleum and natural gas.

The work has been centralized in areas where results will be most significant to the petroleum industry. Oklahoma, Texas, and California were chosen for study, since they not only offer favorable conditions, but also they are the areas where the results of the work seem best calculated to be of service to the industry. Work has been in progress in these three States since the spring of 1927 and the results obtained are briefly mentioned in this article.

Oklahoma. Local structure, chemical action, radioactivity, water circulation, effects of unconformities and effect of strong faulting are considered. Four maps are given.

Texas. Conditions of work, general accomplishment, stratigraphic conditions, relation of earth temperature to structure, regional metamorphism, and relation of rock temperature to oil fields are described.

California. Geologic conditions, plan of work, results, relation of temperature to circulating waters are examined.

Owing to the assistance given to the work described in this article by the U. S. Geological Survey and C. E. Van Orstrand, an outstanding American authority on earth temperatures and methods of measuring them, Heald considers the results obtained to be highly creditable.--W. Ayvazoglou.

(29) DESCRIPTION OF APPARATUS FOR THE MEASUREMENT OF TEMPERATURES IN DEEP WELLS; ALSO, SOME SUGGESTIONS IN REGARD TO THE OPERATION OF THE APPARATUS, AND METHODS OF REDUCTION AND VERIFICATION OF THE OBSERVATIONS.

By C. E. Van Orstrand

American Petroleum Institute, Bulletin 205, 1930, pp. 9-18.

In a brief introduction to the article Van Orstrand says that of the various methods that have been proposed for the measurement of temperature in

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deep wells, two only, the electrical resistance thermometer method and the mercury maximum thermometer method, have yielded results of sufficient importance from the standpoint of efficiency and accuracy to justify their use in making an extended temperature survey.

These two methods are described in this article.

The advantages of the electrical resistance thermometer method over the mercury maximum thermometer method are, according to the author, so great that it will undoubtedly come into general use as soon as the main obstacles--the initial expense of the necessary equipment and the difficulty of constructing leads that will remain intact after being immersed in a mixture of crude oil and salt water--are overcome.

The results of the tests carried out by this method are shown in a depth-temperature curve of deep well, E. T. Price No. 9, South Penn Oil Co. From this figure the minute details of the temperature distribution are evidenced. A brief description of the apparatus is given.

The mercury maximum thermometer method has the disadvantage of being slow and tedious. Its chief advantages are minimum initial expense and the certainty of obtaining an accuracy of rather less than 0.3° F., regardless of the fluid contents of the well. The two methods of handling maximum thermometers, (1) by means of the bailer and (2) by means of a handoperated machine, are described. Thermometer holder and containers, as well as other pieces of apparatus, and several views of hand-operated machine are given in a series of pictures.

The second part of the article deals with some suggestions in regard to the operation of the temperature apparatus: (a) Tests with the oil well machinery, and (b) tests with a hand-operated machine. The operation is explained and the elimination of the chief sources of error in handling the thermometers is mentioned.

The last chapter of the article deals with some suggestions in regard to the correction and verification of the observed temperature data. The possibility of accurate location of the isogeothermal surfaces owing to the difficulty of obtaining a correct answer whether the well is in temperature equilibrium or not is discussed.

In conclusion the author makes statements in regard to the accuracy with which the isogeothermal surfaces can be determined; he says: "That they are smooth uniform surfaces before the drill penetrates the pay sands can not be denied. The real problem, therefore, is the location of these surfaces in their undisturbed condition. Barring the perturbations produced by flowing fluids previously discussed, there remains the instrumental errors of observation."

The errors in depth to the isothermal surface resulting from instrumental errors are estimated.--W. Ayvazoglou.

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(30) DETERMINATION OF GEOTHERMAL GRADIENTS IN OIL FIELDS LOCATED ON ANTICLINAL STRUCTURES IN OKLAHOMA

By John A. McCutchin

American Petroleum Institute, Bulletin 205,
October, 1930, pp. 19-61.

This report contains data which have been collected in the various fields and the conclusions which these data seem to warrant.

Curves from several wells are included and, where practical, are chosen from wells located near the centers of the fields and near the edges of the fields. The curves have been selected from wells which are considered to be in temperature equilibrium, and are the best available from these areas at the present time. It has not been deemed necessary to include curves from all wells tested; since many of them are very similar, and anyone who is further interested may plot the remaining curves from the data presented. The computed and tabulated data from 89 wells are also included.

While the data collected to date on this problem in Oklahoma are by no means sufficiently complete to permit other than preliminary conclusions to be drawn, as a whole, they do tend to support the general premise that the anticlines which have been productive of oil and gas have higher temperatures at given depths than the surrounding areas.

The variations within the individual fields are usually small, but measurable and uniform. The variations from area to area are quite large, and seem to bear a relation to the regional dip of the formations. This latter variation is so marked that all the data collected to date support it.

Due to the nature of the work, which involves the location and testing of the idle wells, most of the data have been collected near and within the fields proper, and very few tests have been made in dry holes located between the fields. This gives the problem a one-sided viewpoint, since it is impossible to know that geothermal anticlines do not exist where no true geological anticlines are to be found.

An interesting possible explanation is suggested by examining the available data. The anticlines which have been the most productive of fluid, either oil or water, show the largest and most uniform variations in temperatures at given depths. It is possible, then, that the removal of large quantities of water and oil from the higher points in the structures has allowed the warmer fluid from the greater depths, either down the dips of the formations or within the formations, to rise in the sands and occupy the pore spaces of the cooler rocks. It seems possible, then, that the abnormally high temperatures which are present in the rocks over the anticlines now may be due to this circulation. It is to be noted that the data which were collected in the Oklahoma City field, before an appreciable amount of fluid had been removed from the field, failed to show a marked variation in temperature with structure.

On the other hand, the data from the few wells located in the non-productive areas indicate that these wells have rather markedly lower

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temperatures at given depths as compared with the temperatures in wells located within the adjacent fields. In most instances, the data from the first 1,000 feet of the hole would have indicated an abnormally low temperature throughout the entire well.

Taken as a whole, the results obtained in Oklahoma to date on this project are neither consistent nor inconsistent enough to warrant any general conclusions as to the outcome of the project. The results do indicate that the problem is not a simple one, and that it will probably be solved by the collection of additional accurate data in the fields and dryhole areas, supplemented perhaps by some careful work on the heat conducting properties of sedimentary rocks in a well-equipped laboratory. Particular attention should be given to the collection of data from fields which are being developed, so that more information will be available from areas where there is no possibility that the operating conditions have influenced it.--Author's abstract.

(31) RESULTS OF DEEP WELL TEMPERATURE MEASUREMENTS IN TEXAS

By E. M. Hawtof

American Petroleum Institute, Bulletin 205, October, 1930, pp. 82-108.

This paper presents a summary of the work of the writer carried out between the dates March, 1927, to January 1, 1929. During this period temperature measurements in deep wells were made in each of the oil yielding provinces of Texas, including the Gulf Coast salt dome province, the interior salt dome province of East Texas, the Luling-Mexia-Powell fault zone province, the Bend Arch, the Panhandle, the Permian Basin of West Texas and Southwest Texas.

A general picture of the geothermal conditions has been secured, which should not only justify certain preliminary conclusions, but should also permit effective planning and conduct of further and more detailed work in selected areas.

Equipment. The apparatus used in making temperature surveys was modeled after that described by Van Orstrand. Photographs of the apparatus are given.

Stem correction for maximum thermometer. All tests were corrected using the stem correction given by the U. S. Bureau of Standards. This correction may amount to as much as 1° F. in deep tests, although it is commonly much less.

Difficulty in securing suitable wells owing to their usually unsettled conditions is noticed.

Geological conditions dealt with. The wells in which temperatures were taken ranged in depth from less than 1,000 to more than 8,000 feet; thus a wide range of different structural types was covered by the work. Some idea of the regional structural conditions is given in a map of Texas showing by structure contours the writer's interpretation of the structural conditions.

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the location of wells that yielded results of particular interest, and the number of feet of depth which, in each of the wells indicated, resulted in an increase in temperature of 1° F.

A series of maps, cross sections, and depth-temperature curves illustrate the article.

Original field notes and temperature tests carried out during this work, showing the county, field, company, well, name and number, are given in an appendix.--W. Ayvazoglou.

(32) GEOTHERMAL CONDITIONS IN OIL PRODUCING AREAS OF CALIFORNIA

By Anders J. Carlson

American Petroleum Institute,
Bulletin 205, October, 1930, pp. 109-139.

This report is a summary of the work concentrated mainly in the Santa Fe Springs and Long Beach fields of the Los Angeles Basin. Therefore, the results are particularly significant only in respect to relations between earth temperatures and local anticlinal structure of the Santa Fe Springs and Long Beach types.

The apparatus used was patterned after that designed by Van Orstrand with some changes made to facilitate operation of the equipment. A depth of 5,000 feet has been reached. Under favorable conditions a 4,000-foot survey could be completed in one day.

The reliability of measurements with this type of apparatus was demonstrated by the re-survey of some wells after a lapse of several months. The comparative average temperatures obtained by the author and by Van Orstrand for one well are shown in a table. This check made with different sets of thermometers is so close as to show that satisfactory results can be obtained by this method.

All tests were corrected using the stem correction formulated by the U. S. Bureau of Standards.

Factors affecting measurements are discussed.

In the attempt to determine whether or not a relationship exists between earth temperatures and geologic structure, the author has compared both isogeothermal surfaces and the distribution of reciprocal gradients to geologic structure. He concluded that in general the work in California indicated that the isothermal depth was a more reliable medium of comparison than the reciprocal gradient. This is explained by the fact that shallow temperatures seem to be more seriously affected by artificial conditions than do deep temperatures, and this would tend to affect the gradient of a well to a greater degree than it would the depth of the 100° isotherm.

Geological conditions under which the measurements were made and the types of wells used are described. Temperature determinations in 33 wells in

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the Santa Fe Springs fields were made. The depth-temperature curves for these wells are shown in Figures 9 to 41. A table showing the geothermal data is given.

Geothermal data for 43 wells in Long Beach Oil field are shown in a table.

Conclusions from the study of the data presented, for both the Santa Fe Springs and Long Beach oil fields, are drawn.--W. Ayvazoglou.

(33) SULLA PREVISIONE DELLA TEMPERATURA NELL'INTERNO DELLE MONTAGNE

(PREDICTION OF TEMPERATURE INSIDE OF MOUNTAINS)

By Mario Bossolasco

Ergänzungshefte fuer Angewandte Geophysik,
vol. 1, No. 2, 1930, pp. 149-155.

After a few remarks on the practical value of different methods for the prediction of the temperature of rocks inside of mountains, the author mentions the importance of the position of the strata for the solution of these problems and explains by this the high maximum temperature which was established in the Simplon Tunnel.

He shows that the normal course of the geoisotherms can not be affected in a sensible way by hot springs. This is in contradiction to a confirmation made previously.--Author's abstract translated by W. Ayvazoglou.

7. UNCLASSIFIED METHODS

(34) MATHEMATICS AND THE PROBLEM OF ORE LOCATION

By Warren Weaver

The American Mathematical Monthly, vol. 37, No. 4, 1930, pp. 165-181.

The author divides his article into four parts:

A. Introduction. Some branches of earth physics by which the subsurface exploration is possible are considered.

B. The methods of geophysical exploration for ore and oil (magnetic method, electrical method, electromagnetic method, gravitational method, and the seismic method) are briefly discussed and illustrated by six figures.

C. The mathematical problems, as connected with the geophysical methods of prospecting are examined. Weaver notes the difference of the problems of geophysics from many classical problems which he characterizes as follows: First of all, they are two or three-dimensional problems; second, there are always three important regions of space involved, each with its own characteristic electrical properties--the air, the normal homogeneous earth, and the

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ore masses; third, it is necessary to have exact knowledge near the sources of disturbance, rather than far away, as in the classical problem of radio signals; fourth, it is useful, in the electromagnetic case, to obtain solutions when the wave length is comparable with the dimensions of the diffracting ore mass, rather than small, as in the classical optical case; fifth, it is necessary, in general, to assign finite but different conductivities to the various regions under consideration; sixth, many regions of geometrical shapes, which were previously of only academic interest, now become of great practical interest; and, last, it is essential now that the solutions be usable from a computative point of view.

D. Conclusions. The first application of divining rods to the location of ore, as described in an old treatise of mining written by Georgius Agricola and published in 1556 (translated from the Latin by Herbert Hoover), is mentioned and the complicated equipment of the geophysicist of to-day with his dip needle, his voltmeter, radio apparatus, slide-rule and his textbook on partial differential equations is noted.--W. Ayvazoglou.

(35) GEOPHYSICS AND DEEP DRILLING SHAPE DESTINY OF GULF COAST

By Jack Logan

The Oil Weekly, vol. 59, No. 3, 1930, pp. 63-66.

The results of geophysical exploration and deeper drilling in the Gulf Coast field are summed up. According to information given by Logan, instead of approximately 40 domes and fields as in 1923, the Gulf Coast now has more than twice that number. The potentialities of the coastal area have besides not merely been doubled by the 100 per cent increase in the number of domes and fields, but they have been multiplied perhaps several times by accessibility in both old and new fields of deep sands which formerly could not be reached with the drill.

The immense increase in potentialities of the Gulf Coast as a source of oil is due to two principal factors: Deep drilling and geophysical exploration.

In this article the author discusses in more detail geophysical exploration as a factor by which the potentialities of the salt-dome oil country have been greatly widened.

Tables listing all old domes and geophysically discovered fields and prospects and a special map showing those numerous areas are given. The tables and the map reveal the brilliant record achieved by geophysics and the geophysicists.--W.Ayvazoglou.

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(36) RECHERCHES SUR LES PERTURBATIONS ÉLECTROMAGNETIQUES, SISMIQUES ET SOLAIRES

(INVESTIGATIONS ON ELECTROMAGNETIC, SEISMIC AND SOLAR DISTURBANCES)

By Allert Nodon

Comptes Rendus de l'Academie des Sciences, Paris,
vol. 188, No. 10, 1929, pp. 725-726.

Investigations were made during almost two years by Boustos Navarette, Director of the Observatory del Salto in Santiago (Chile). Nodon's magnetograph was used.

Graphs obtained from observations made by magnetograph, seismograph, and galvanometer, as well as those made on the variations of sun spots proved the existence of a close relation between all of them.

From the results of these observations the important conclusion can be drawn that earthquakes can be predicted from the indications of the magnetograph several hours in advance.--W. Ayvazoglou.

(37) A BRIEF REVIEW OF ARTICLES APPEARING IN VOL. 2, NOS. 1, 2, AND 3 OF THE "BOLETIN DE LA ASOCIACION GEOFISICA DE MEXICO"

Boletin de la Asociacion Geofisica de Mexico,
vol. 2, Nos. 1, 2 and 3, 1930, pp. 1-78.

1. The physical principles of the gravitational method of prospecting, by B. P. Nikiforov. Continuation of the translation into English, pp. 15-22; into Spanish, pp. 39-45 and 61-66. Both parts translated by Prof. J. Korzujin.

2. Mathematical principles for topographic correction in gravimetrical work. By V. A. Olhovich. The article is to be continued.

3. Review of Geophysical Prospecting for Petroleum, 1929. This is Donald C. Barton's article published in the Bulletin of the American Association of Petroleum Geologists, vol. 14, No. 9, 1930, pp. 1105-1129 (see Geophys. Abs. No. 18), translated into Spanish by Manuel Alvarez.

4. Geophysical Methods of Prospecting, by Georges A. Boutry. Continuation of the French article translated into Spanish by L. Urguijo, Eng. (see Geophys. Abs. No. 8).--W. Ayvazoglou.

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(38) SCHALLGESCHWINDIGKEIT UND TEMPERATUR IN DER STRATOSPHÄRE

(VELOCITY OF SOUND AND THE TEMPERATURE IN THE STRATOSPHERE)

By B. Gutenberg

Gerlands Beiträge zur Geophysik,
vol. 27, No. 2, 1930, pp. 217-225.

The registrations of air waves confirm consequences drawn previously from ear observations. The results gained from the graphs show that the height in which velocity of sound and temperature begin to increase is not the same in all cases. Sometimes, especially in winter and in spring, it is as low as 20 kilometers. A simple method of calculation to find the sound velocity in the stratosphere is given.--Author's abstract.

8. GEOLOGY

(39) DIE RANDWERTAUFGABE DER GEODÄSIE

(THE BOUNDARY-VALUE PROBLEM OF GEODESY)

By F. Hopfner

Gerlands Beiträge zur Geophysik, vol. 27, No. 3-4, 1930, pp. 312-325.

The problem of determining the level extending into the sea-level (as it is known below continents it extends inside of the earth crust) by observed and properly reduced values of gravity comes under boundary-value problems of the second kind among which it holds the place between the exterior and interior space problems. In this article the author gives the solution of this problem with the aid of special functions of Green. The boundary-value problem of the first kind is solved also.--Author's abstract.

9. NEW BOOKS

(40) Krahmann, Rudolf. Die Anwendbarkeit der geophysikalischen Lagerstättenuntersuchungsverfahren, insbesondere der elektrischen und magnetischen Methoden (The Applicability of geophysical methods for prospecting deposits, especially of the electrical and magnetic methods). With 37 figures. Price, R.M. 2.50. This is the 3d volume of the "Abhandlungen zur praktischen Geologie und Bergwirtschaftslehre" issued by Prof. Dr. Georg Berg (Berlin, Geologische Landesanstalt).

(41) Stoner, Edmund C. Magnetism. E. P. Dutton and Co., New York, 1929. pp. Vii, 117, 20 figs., Price, $1.10. The topics treated are: The magnetic properties of atoms; diamagnetism as a general property of all matter; paramagnetism; ferromagnetism; the magnetic properties of the elements and the change of electrical conductivity in strong magnetic field.

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March, 1931.

INFORMATION CIRCULAR

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SPECIALLY RECOMMENDED TRAILING CABLES[1]

(Cables added to recommended list during December, 1930)

By L. C. Ilsley[2]

A specially recommended cable is a rubber-sheathed cable that has met the minimum performance requirements for cables as set forth in Schedule 2C.[3]

The first in the series of recommended cables was listed September, 1930, by an advance notice published as Information Circular 6375[4] which described the conditions under which the cable tests were made. Since that time six additional cables have met the test requirements and have been specially recommended. The complete list of specially recommended cables is as follows:

Specially recommended cables

Cable	Symbol No.	Stranding	Manufacturer
Hazacord No. 2	BM1	19 x 7	Hazard Insulated Wire Works (division of the Okonite Co.)
Hazacord No. 3	BM2	do.	Do.
Hazacord No. 4	BM3	do.	Do.
Super-service No. 3	BM4	7 x 19	Rome Wire Company (division of the General Cable Corporation)
Super-service No. 2	BM5	do.	Do.
Super-service No. 4	BM6	do.	Do.
Super-service No. 4	BM7	7x 7	Do.

The cables listed were all twin (parallel duplex) cables having outer belts or coverings of approximately ⅛-inch high-grade rubber compound, and have the same general appearance and relative dimensions as the types of twin cables in general use.

The cables were tested under conditions designed to show their approximate performance under mine conditions. Only twin-type cables have met these test conditions. Although the recommended trailing cables are much better and safer for mine use than other cables and withstand being run over by a 7-ton car, they should not be considered as 100 per cent safe.

The 7-ton car test represents the minimum limit requirement effective at present under Schedule 2-C, but the test car operates on a straight and level track, and thus does not represent the more severe conditions of mine use such as might result from uneven and curved tracks.

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1 The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6442."

2 Electrical engineer, U. S. Bureau of Mines, Pittsburgh Experiment Station, Pittsburgh, Pa.

3 U. S. Bureau of Mines, Explosion-Proof Mine Equipment Requirements for Approval of Storage-Battery Locomotives and Power Trucks, Junction Boxes and Electric Motor-Driven Equipment: Schedule 2C, February, 1930, 27 pp.

4 Ilsley, L. C., Special Recommended Trailing Cable (advance notice): Information Circular 6375, Bureau of Mines,

4 Ilsley, L. C., Special Recommended Trailing Cable (advance notice): I. C. 6375, Bureau of Mines, 1930, 2pp.

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